

WHAT IS CLAIMED IS:

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1. A method of reducing a size of a binary image, comprising the steps of:

reducing the size of the binary image in a sub-scanning direction by using a conditional OR process; and

limiting a size-change point determined by a reduction rate to an odd-number line or an even-number line.

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2. The method of reducing the size of a binary image as claimed in claim 1, further comprising the step of thinning out an image of either a line immediately preceding or a line immediately following the size-change point.

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3. A method of reducing a size of a binary image, wherein a reduction process in a sub-scanning direction comprises the steps of:

5 thinning out an image of an odd-numbered line and producing a reduced image using a conditional OR process for an even-number line immediately following the odd-number line when a size-change point determined by a reduction rate is the odd-number line,

10 producing a reduced image using a conditional OR process for an even-number line and thinning out an image of an odd-number line immediately following the even-number line when the size-change point determined by the reduction rate is the even-number line.

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4. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces but does not output the reduced image and instead outputs a non-reduced image for the even-number line.

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5. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces and outputs the reduced image when the size-change point determined by the reduction rate is the even-number line.

6. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line when the immediately preceding odd-number line is not thinned out.

7. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces and outputs a reduced image for the even-number line when the immediately preceding odd-number line is thinned out.

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8. A method of reducing a size of a binary image, wherein a reduction process in a sub-scanning direction comprises the steps of:

5 thinning out an image of an even-numbered line and producing a reduced image using a conditional OR process for an odd-number line immediately following the even-number line when a size-change point determined by a reduction rate is the even-number line,

10 producing a reduced image using a conditional OR process for an odd-number line and thinning out an image of an even-number line immediately following the odd-number line when the size-change point determined by the reduction rate is the odd-number line.

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9. The method of reducing the size of a binary image as claimed in claim 8, wherein the method
20 produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number line.

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10. The method of reducing the size of a binary image as claimed in claim 8, wherein the method produces and outputs a reduced image for the odd-number line.

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11. The method of reducing the size of a binary image as claimed in claim 8, wherein the method produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number line when the immediately preceding even-number line is not thinned out.

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12. The method of reducing the size of a binary image as claimed in claim 8, wherein the method produces and outputs a reduced image for the odd-numbered line when the immediately preceding even-number line is thinned out.

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13. The method of reducing the size of a binary image as claimed in claim 1, wherein the size of the binary image in a scanning direction is reduced before the size of the binary image in the sub-scanning direction is reduced.

10 14. The method of reducing the size of a binary image as claimed in claim 1, wherein, when a target reduction rate is 50 percent or below, a binary image of the target reduction rate is produced by reducing the size of the binary image in the sub-
15 scanning direction to twice the target reduction rate using a simple thinning-out method and further reducing the reduced binary image to the target reduction rate using the conditional OR process.

15. An image processing device for processing
20 a binary image comprising:

an image size reduction component that reduces the size of the binary image in a sub-scanning direction by using a conditional OR process; and

a limiting component that limits a size-change
25 point determined by a reduction rate to an odd-number

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line or an even-number line.

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16. The image processing device as claimed in claim 15, further comprising a component that thins out an image of either a line immediately preceding or a line immediately following the size-change point.

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17. An image processing device for processing
15 a binary image comprising:

a first component that thins out an image of an odd-numbered line and produces a reduced image using a conditional OR process for an even-number line immediately following the odd-number line when a size-
20 change point determined by a reduction rate is the odd-number line; and

a second component that produces a reduced image using a conditional OR process for an even-number line and thins out an image of an odd-number line
25 immediately following the even-number line when the

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size-change point determined by the reduction rate is the even-number line.

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18. The image processing device for processing a binary image as claimed in claim 17, wherein the device produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line.

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19. The image processing device for processing a binary image as claimed in claim 17, wherein the device produces and outputs the reduced image for the even-number line.

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20. The image processing device for processing a binary image as claimed in claim 17, wherein the

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device produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line when the immediately preceding odd-number line is not thinned out.

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21. The image processing device for processing
10 a binary image as claimed in claim 17, wherein the device produces and outputs a reduced image for the even-number line when the immediately preceding odd-number line is thinned out.

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22. An image processing device for processing
a binary image method comprising:

20 a first component that thins out an image of an even-numbered line and produces a reduced image using a conditional OR process for an odd-number line immediately following the even-number line when a size-change point determined by a reduction rate is the even-
25 number line; and

a second component that produces a reduced image using a conditional OR process for an odd-number line and thins out an image of an even-number line immediately following the odd-number line when the size-
5 change point determined by the reduction rate is the odd-number line.

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23. The image processing device for processing a binary image as claimed in claim 22, wherein the device produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number
15 line.

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24. The image processing device for processing a binary image as claimed in claim 22, wherein the device produces and outputs a reduced image for the odd-number line.

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25. The image processing device for processing
a binary image as claimed in claim 22, wherein the
device produces but does not output a reduced image and
instead outputs a non-reduced image for the odd-number
5 line when the immediately preceding even-number line is
not thinned out.

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26. The image processing device for processing
a binary image as claimed in claim 22, wherein the
device produces and outputs a reduced image for the odd-
number line when the immediately preceding even-number
15 line is thinned out.

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27. The image processing device as claimed in
claim 15, wherein the image size reduction component
reduces the size of the binary image in a scanning
direction before reducing the size of the binary image
in the sub-scanning direction.

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28. The image processing device as claimed in
claim 15, wherein the image size reduction component,
when a target reduction rate is 50 percent or below,
produces a binary image of the target reduction by
5 reducing the size of the binary image in the sub-
scanning direction using a simple thinning-out method to
twice the target reduction rate and further reduces the
reduced binary image to the target reduction rate using
the conditional OR process.

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29. The image processing device as claimed in
15 claim 15, wherein the image size reduction component,
when a current process line is other than the size-
change point, reads and then discards data of an
immediately preceding line memory component, and
rewrites data read from a memory component in which a
20 preceding reduction result is stored to the preceding
line memory component.

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30. An image processing device for processing
a binary image comprising:

a conditional OR processing component that
reduces a size of an image in a sub-scanning direction
5 using a conditional OR process;

a reduction result line memory component that
stores data output from the conditional OR processing
component;

an immediately preceding line memory component
10 that stores binary image data of an immediately
preceding line; and

a control component that inputs binary image
data of a current processing line, preceding reduction
result data read from the reduction result line memory
15 component, and binary image data of an immediately
preceding line read from the immediately preceding line
memory component to the conditional OR processing
component so as to perform conditional OR processing of
the current processing line, and limits a size-change
20 point determined by a reduction rate and employing the
data output from the conditional OR processing component
to either an odd-number line or an even-number line.

31. The image processing device as claimed in
claim 30, wherein the control component further thins
out an image of either a line immediately preceding or a
line immediately following the odd-number line or the
5 even-number line corresponding to the size-change point.

10 32. An image processing device for processing
a binary image comprising:
a conditional OR processing component that
reduces a size of an image in a sub-scanning direction
using a conditional OR process;
15 a reduction result line memory component that
stores data output from the conditional OR processing
component;
an immediately preceding line memory component
that stores binary image data of an immediately
20 preceding line; and
a control component that inputs binary image
data of a current processing line, preceding reduction
result data read from the reduction result line memory
component, and binary image data of an immediately
25 preceding line read from the immediately preceding line

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memory component to the conditional OR processing component so as to perform conditional OR processing of the current processing line, wherein:

when a size-change point determined by a
5 reduction rate is an odd-number line, the control component thins out an image of the odd-number line and reduction data is produced by the conditional OR processing component for an even-number line immediately succeeding the odd-number line; and

10 when the size-change point determined by the reduction rate is an even-number line, reduction data is produced by conditional OR processing component for the even-number line and thins out an image of an odd-number line immediately succeeding the even-number line.

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20 33. The image processing device for processing a binary image as claimed in claim 32, wherein the device does not output the produced reduction data and instead outputs non-reduction data for the even-number line.

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34. The image processing device for processing a binary image as claimed in claim 32, wherein the device produces and outputs the reduced image for the even-number line.

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35. The image processing device for processing a binary image as claimed in claim 32, wherein the device produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line when the immediately preceding odd-number line is not thinned out.

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36. The image processing device for processing a binary image as claimed in claim 32, wherein the method produces and outputs a reduced image for the even-number line when the immediately preceding odd-number line is thinned out.

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37. An image processing device for processing
a binary image comprising:

a conditional OR processing component that
reduces a size of an image in a sub-scanning direction
5 using a conditional OR process;

a reduction result line memory component that
stores data output from the conditional OR processing
component;

an immediately preceding line memory component
10 that stores binary image data of an immediately
preceding line; and

a control component that inputs binary image
data of a current processing line, preceding reduction
result data read from the reduction result line memory
15 component, and binary image data of an immediately
preceding line read from the immediately preceding line
memory component to the conditional OR processing
component so as to perform conditional OR processing of
the current processing line, wherein:

20 when a size-change point determined by a
reduction rate is an even-number line, the control
component thins out an image of the even-number line and
produces reduction data by the conditional OR processing
component for an odd-number line immediately succeeding
25 the even-number line; and

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when the size-change point determined by the reduction rate is an odd-number line, the control component produces reduction data output by the conditional OR processing component for the odd-number line and thins out an image of an even-number line immediately succeeding the odd-number line.

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38. The image processing device for processing a binary image as claimed in claim 37, wherein the device produces but does not output the reduced image and instead outputs a non-reduced image for the odd-number line.

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39. The image processing device for processing a binary image as claimed in claim 37, wherein the method produces and outputs a reduced image for the odd-number line.

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40. The image processing device for processing
a binary image as claimed in claim 37, wherein the
method produces but does not output a reduced image and
instead outputs a non-reduced image for the odd-number
5 line when the immediately preceding even-number line is
not thinned out.

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41. The image processing device for processing
a binary image as claimed in claim 37, wherein the
method produces and outputs a reduced image for the odd-
number line when the immediately preceding even-number
15 line is thinned out.

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42. The image processing device as claimed in
claim 30, wherein the control component reduces the size
of the binary image in a scanning direction before
reducing the size of the binary image in the sub-
scanning direction.

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43. The image processing device as claimed in claim 30, wherein the control component, when a target reduction rate is 50 percent or below, produces a binary image of the target reduction rate by reducing the size of the binary image in the sub-scanning direction to twice the target reduction rate using a simple thinning-out method and further reducing the reduced binary image to the target reduction rate using the conditional OR process.

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44. A method of controlling an image processing device for processing a binary image, the method comprising the steps of:

reducing a size of an image in a sub-scanning direction using a conditional OR process conducted by a conditional OR processing component;

20 storing data output from the conditional OR processing component in a reduction result line memory component;

storing binary image data of an immediately preceding line in an immediately preceding line memory component;

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inputting binary image data of a current
processing line, preceding reduction result data read
from the reduction result line memory component, and
binary image data of an immediately preceding line read
5 from the immediately preceding line memory component to
the conditional OR processing component so as to perform
conditional OR processing of the current processing
line; and

limiting a size-change point determined by a
10 reduction rate and employing the data output from the
conditional OR processing component to either an odd-
number line or an even-number line.

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45. The method of controlling an image
processing device for processing a binary image as
claimed in claim 44, further comprising the step of

20 thinning out an image of either a line
immediately preceding or a line immediately following
the odd-number line or the even-number line
corresponding to the size-change point.

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46. A method of controlling an image processing device for processing a binary image, the method comprising the steps of:

reducing a size of an image in a sub-scanning
5 direction using a conditional OR process conducted by a conditional OR processing component;

storing data output from the conditional OR processing component in a reduction result line memory component;

10 storing binary image data of an immediately preceding line in an immediately preceding line memory component;

inputting binary image data of a current processing line, preceding reduction result data read
15 from the reduction result line memory component, and binary image data of an immediately preceding line read from the immediately preceding line memory component to the conditional OR processing component so as to perform conditional OR processing of the current processing
20 line;

thinning out an image of an odd-number line and causing reduction data to be produced by the conditional OR processing component for an even-number line immediately succeeding the odd-number line when a
25 size-change point determined by a reduction rate is the

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odd-number line; and

causing reduction data produced by the
conditional OR processing component for an even-number
line and thinning out an image of an odd-number line
5 immediately succeeding the even-number line when the
size-change point determined by the reduction rate is
the even-number line.

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47. The method of controlling an image
processing device for processing a binary image as
claimed in claim 46, wherein the step of producing a
15 reduced image using the conditional OR process produces
but does not output the reduced image and instead
outputs a non-reduced image for the even-number line.

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48. The method of controlling an image
processing device for processing a binary image as
claimed in claim 46, wherein the step of producing a
25 reduced image using the conditional OR process produces

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and outputs the reduced image for the even-number line.

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49. The method of controlling an image
processing device for processing a binary image as
claimed in claim 46, wherein the step of producing a
reduced image using the conditional OR process method
10 produces but does not output a reduced image and instead
outputs a non-reduced image for the even-number line
when the immediately preceding odd-number line is not
thinned out.

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50. The method of controlling an image
processing device for processing a binary image as
20 claimed in claim 46, wherein the step of producing a
reduced image using the conditional OR process method
produces and outputs a reduced image for the even-number
line when the immediately preceding odd-number line is
thinned out.

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51. A method of controlling an image processing device for processing a binary image, the method comprising the steps of:

reducing a size of an image in a sub-scanning
5 direction using a conditional OR process conducted by a conditional OR processing component;

storing data output from the conditional OR processing component in a reduction result line memory component;

10 storing binary image data of an immediately preceding line in an immediately preceding line memory component;

inputting binary image data of a current processing line, preceding reduction result data read
15 from the reduction result line memory component, and binary image data of an immediately preceding line read from the immediately preceding line memory component to the conditional OR processing component so as to perform conditional OR processing of the current processing
20 line;

thinning out an image of an even-number line and causing reduction data to be produced by the conditional OR processing component for an odd-number line immediately succeeding the even-number line when a
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even-number line; and

causing reduction data produced by the
conditional OR processing component for an odd-number
line and thinning out an image of an even-number line
5 immediately succeeding the odd-number line when the
size-change point determined by the reduction rate is
the odd-number line.

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52. The method of controlling an image
processing device for processing a binary image as
claimed in claim 51, wherein the method produces but
15 does not output a reduced image for the odd-number line.

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53. The method of controlling an image
processing device for processing a binary image as
claimed in claim 51, wherein the method produces and
outputs a reduced image for the odd-number line.

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54. The method of controlling an image processing device for processing a binary image as claimed in claim 51, wherein the method produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number line when the immediately preceding even-number line is not thinned out.

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55. The method of controlling an image processing device for processing a binary image as claimed in claim 51, wherein the method produces and outputs a reduced image for the odd-number when the immediately preceding even-number line is thinned out.

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56. The method of controlling an image processing device for processing a binary image as claimed in claim 44, wherein the size of the binary image in a scanning direction is reduced before the size of the binary image in the sub-scanning direction is

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reduced.

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57. The method of controlling an image
processing device for processing a binary image as
claimed in claim 44, wherein, when a target reduction
rate is 50 percent or below, a binary image of the
10 target reduction rate is produced by reducing the size
of the binary image in the sub-scanning direction to
twice the target reduction rate using a simple thinning-
out method and further reducing the reduced binary image
to the target reduction rate using the conditional OR
15 process.

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